

### **REMARKS**

In the Office Action mailed September 4, 2008, the Examiner initially rejected claims 64 and 70 under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention. Specifically, the Examiner objected to the phrase “such as” in claim 70. By the present response, claim 70 has been amended to address the indefinite language identified by the Examiner.

The Examiner further objected to claim 64 as including the recitation “preferably the anode”. By the present response, claim 64 has been amended to correct this claim language identified by the Examiner in the Office Action.

Based upon the amendments to claims 64 and 70, the applicant has addressed the §112 rejections made by the Examiner in the Office Action.

In the Office Action, claims 36, 38-39, 43-45, 49, 51, 54-55, 57-59, 63-64, 66-67 and 70 were rejected under 35 USC §102(b) as being anticipated by the Savage U.S. Patent No. 4,731,515. Claims 36, 38, 45, 48-50, 52, 54, 57-59, 64, 66-67 and 70 were also rejected under §102(d) as being anticipated by the Kuehnle U.S. Patent No. 5,879,518. The remaining claims not rejected under §102(b) have been rejected by the Examiner based upon either the Savage ‘515 reference or the Kuehnle ‘518 reference in combination with several other references specifically applied by the Examiner in rejecting the dependent claims under §103(a).

Reconsideration of the above claim rejections is respectfully requested in view of the foregoing claim amendments and the following arguments for allowance.

### **§102(b) Rejection Based on Savage U.S. Patent 4,731,515**

In the Office Action, the Examiner has alleged that claims 36, 38-39, 43-45, 49, 51, 54-55, 57-59, 63-64, 66-67 and 70 lack novelty over the Savage U.S. Patent 4,731,515 (hereinafter “Savage”). Savage is concerned with electromechanical machining of material from electrodes by means of an electrical arc produced by applying short-duration electrical pulses (i.e. during each duty cycle the current is switched on and off).

By contrast, independent claims 36 and 54 (and hence all claims dependent thereon) require the use of a stable arc maintained between two electrodes. It is clear from the language of the independent claims 36 and 54 and the description of the present application that the pulsed arc of Savage does not fall within this definition. In all examples of the present application, current is applied and maintained until the end of the experiment without pulsing to create the stable arc required by claims 36 and 54.

Additionally, it is to be noted that the method of Savage produces much larger particles than the sub-micron particles produced by the method of the presently-claimed invention. For example, in column 4, lines 1 to 3, Savage refers to particles in the 50 to 300 micron range and column 4, line 20, refers to particles in the 10 to 200 micron range. Although Figure 6 of Savage is said to show 'many small, less than 10 micron' size particles, there is no suggestion that a significant number of sub-micron particles are produced. Indeed, it is submitted that when using a pulsed discharge, sub-micron particles cannot be obtained to any significant extent. Independent claims 36 and 54 and dependent claims 37-53 and 55-58 are therefore novel over the disclosure of Savage.

In further relation to independent claim 54 and dependent claims 55 and 57, the Examiner has alleged that powder produced during arc vaporization will inherently be deposited *as a coating* on an electrode. Nothing in the Savage reference supports such assertion and the Examiner has provided no evidence to support this assertion, which it is submitted is entirely without basis. Furthermore, claim 54 has now been amended to require the use of a stable arc. As noted above, Savage discloses only the use of a pulsed arc.

In relation to independent claim 59 and dependent claims 63-64, 66-67 and 70, it is noted that claim 59 has now been amended to incorporate the subject matter of claim 69. Since claim 69 was not rejected based on a combination of references including the Savage reference, it is submitted that amended claim 59 and all of its dependent claims are allowable over the Savage reference.

**§102 Rejection Based on Kuehnle U.S. Patent 5,879,518**

In the Office Action, the Examiner further alleges that claims 36, 38, 45, 48-50, 52, 54, 57-59, 64, 66-67 and 70 are anticipated by the Kuehnle U.S. Patent No. 5,879,518 (hereinafter "Kuehnle"). Kuehnle discloses a pair of elongated hollow electrodes separated by a gap, across which an arc is created to vaporize electrode material. It is noted however that, in the disclosure of Kuehnle, the electrodes are not placed in coolant as required by claim 36 (and all claims dependent thereon). While it is clear from consideration of Figure 4 of Kuehnle that an annular curtain of cold gas (114) is formed outside of the electrode ends 34c and 66c (see also column 4, lines 3 to 12), the gas passed through the interior of the electrodes (to the gap separating them) serves as a carrier and not as a coolant. This is made particularly clear in the paragraph bridging columns 4 and 5 of Kuehnle, including the statement that 'the droplets are subjected to a sudden temperature drop' as they are swept into the annular curtain of cold argon gas. There is no suggestion that the argon passing through the center of the electrodes is cooled. Rather, there is an explicit statement (column 5, lines 55 to 56) that the gas delivered to the gap G between the electrodes is in fact heated by passage through the electrodes. Independent claim 36 and dependent claims 38, 45, 48-50 and 52 require the first and second electrodes to be placed in a volume of coolant and are therefore novel over the disclosure of Kuehnle.

As above, in relation to claims 54 and 57, it is noted that no evidence has been provided to support the assertion that formation of a coating on one of the electrodes is inherent to the process disclosed in Kuehnle. Furthermore, the formation of such a coating would appear to be unlikely, given the constant stream of carrier gas removing vaporized material from the gap between the electrodes. Since the material does not solidify until it reaches the outer annular stream of cold argon gas, well away from the electrodes (column 5, lines 4 to 6), it is not clear why the Examiner believes this process to be inherently disclosed. Claims 54-58 are therefore also novel over Kuehnle alone.

In relation to independent claim 59 and dependent claims 64, 66, 67 and 70, it is again noted that claim 59 has now been amended to incorporate the subject matter of

claim 69. Since the novelty objection was not applied to claim 69, it is submitted that these claims are therefore novel over Kuehnle.

### **§103 Claim Rejections**

In the Office Action, the Examiner rejected claim 37 as being obvious over a combination of Savage or Kuehnle with Harris. The applicant objects to such rejections since these documents are incompatible and would not be considered in combination by the skilled person. Harris is concerned with a method of prevention of arcing in a vacuum (column 1, lines 52 to 58), whereas both Savage and Kuehnle require arcs. As such, the teachings of Harris are considered to be irrelevant to the production of metal powders, and would not be considered by the skilled person. Furthermore, Harris does not address the features of claim 36 which are not found in the Savage and Kuehnle, as discussed above.

The Examiner further alleges (paragraph 11) that claims 53 and 69 are obvious over a combination of Kuehnle and Zurecki. However, it is submitted that Zurecki does not disclose the required feature of separating particles from the coolant and returning coolant to the electrodes (claim 53), or of a powder recovery region (claim 69) within the meaning of the present application. In Zurecki, the electrodes are not placed within the coolant (Figure 1), and so it cannot be said that line 219 returns coolant to the electrodes. Furthermore, Zurecki does not disclose any feature capable of separating coolant from powder in a manner that would allow the coolant to be reused. Thirdly, and contrary to the Examiner's assertion, vessel 200 does not allow the recovery of powder from the cryogen in which it is suspended, but only draining of the whole slurry through valve 209 (column 6, lines 27 to 30). It is not therefore a 'powder recovery region'. Once the cryogen has been drained in this way, it cannot be returned to the main container via line 200.

In paragraphs 12 and 13 of the Office Action, the Examiner alleges that the choice of a particular thickness of coating is obvious, given the inherent disclosure of a coating process in both Savage and Kuehnle. As noted above, the inherency of this disclosure is

not accepted. Furthermore, it is not apparent what motivation would be provided for the skilled man to carry out the 'routine experimentation' referred to by the Examiner, given that he has not been made aware of the possibility of coating by either document.

The Examiner has alleged (paragraph 14) that claims 40-42 and 61-62 are obvious over a combination of either Savage or Kuehnle with Yanagiya. This is not accepted. Firstly, in order to produce the composite powders described, the electrode of Yanagiya must be rotated at high speed. This is not possible with the methods and apparatuses disclosed in Savage and Kuehnle, and there is no suggestion that similar effects could be obtained in the absence of such rotation. Furthermore, as noted above, neither Savage nor Kuehnle discloses the preparation of sub-micron particles. This feature is additionally absent from Yanagiya, and there is no suggestion that either combination of documents would necessarily result in this feature.

In paragraphs 16 and 17, the Examiner alleges that claims 46 and 47 are obvious over a combination of either Savage or Kuehnle with Kemp. Kemp teaches the use of solvent and surfactant for removing water from fine metal nano-powders, with no reference being made to the method by which the powders are produced. The solvent and surfactant are added to the powder after production and after excess water has been removed (column 2, lines 22 to 35). Kemp also teaches that the surfactant may then be removed from the powder, indicating that the surfactant has no function other than removal of water (column 3, lines 11-26). Neither Savage nor Kuehnle exposes the powders produced therein to water during production, so that there is no motivation for the skilled man to apply the teaching of Kemp to either document. In particular, none of the documents disclose any benefit to be obtained through application of surfactant to powder in the absence of water, or the longer-term protective effects of the use of surfactant.

The Examiner has alleged (in paragraph 18) that claim 60 is obvious over a combination of either Savage or Kuehnle with Boxman. Claim 60 is dependent on claim 59 which, as noted above, is novel over both Savage and Kuehnle by virtue of at least the

provision of an inlet and an outlet for coolant, with a coolant return circuit and a powder recovery region, as specified in previous claim 69.

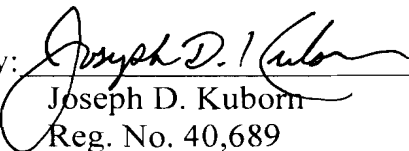
Similarly, the Examiner has alleged that claim 68 is obvious over a combination of either Savage or Kuehnle with Aoyama. Again, claim 68 is ultimately dependent on claim 59, and the undisclosed features of previous claim 69 are not found in Aoyama.

**Conclusion**

Based on the foregoing claims amendments and the argument for allowance, claims 36-68 and 70 are believed to be allowable over the combination of references cited by the Examiner. The Examiner is invited to contact the applicant's undersigned attorney with any questions or comments, or to otherwise facilitate prosecution of the present application.

Respectfully submitted,

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